PATENT APPLICATION

Attorney Docket No. A04016US (98813.2)

TITLE OF THE INVENTION

"METAL BUILDING CONSTRUCTION"

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CROSS-REFERENCE TO RELATED APPLICATIONS

Not applicable

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not applicable

REFERENCE TO A "MICROFICHE APPENDIX"

Not applicable

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to metal building constructions. More particularly, the present invention relates to an improved metal building construction that utilizes metal wall panels having edge portions that interlock in a unique manner including at corners, doors and windows using specially configured Z-shaped portions. Each of the panels provide flange portions that extend toward each other enabling connection thereto of standard inside surface building materials such as Sheetrock®, paneling, etc.

2. General Background of the Invention

Buildings have been constructed of metal framework in many fashions. The following table lists patents that show examples of buildings that use a metal framework. A review of these patents will show that some of them use vertically oriented interlocking panels having Z-shaped interlocking portions.

Table 1

Patent Number	Title	Issue Date
4,594,822	Structural Panel for	06/17/1986

	Building Structure	
5,117,602	Structural Panel for Pre-fabricated Buildings	06/02/1992
5,979,136	Prefabricated Structure Panel	11/09/1999

BRIEF SUMMARY OF THE INVENTION

The present invention provides a metal building that includes an underlying support such as a slab supporting a plurality of walls that are formed of generally vertically oriented interlocking metal panels, each wall having an outer surface and an inner surface.

The metal panels include wall panels having opposed wall panel edge portions. The metal panels also include a plurality of metal corner panels having opposing corner edge portions that each connect with a pair of wall panels at wall panel edge portions. The wall panel edge portion of one panel connect with edge portions of two other metal panels such as for, for example, a corner panel and a wall panel, or two wall panels, or a panel that is part of a door or part of a window truss.

Each of the panels have side panel sections with respective opposed flange portions that extend toward each other. Connections join the panels together at interlocking sections that are in part Z-shaped and that extend transversely with respect to the wall outer surface.

The wall inner surface is preferably defined by a veneer (for example, sheet rock, wood paneling, synthetic paneling or the like) that is connected to the metal panels at the flange portions. A cover (for example, roof) attaches to the walls to shield all or part of the interior of the building from the elements.

The metal building preferably includes at least one wall with a door. The metal building can include at least one wall with a window. The wall panels each have a width. The door has a width. The door width is less than the width of a plurality of short wall panels that are part of

a truss positioned above the door. The wall panels have a width and each window has a width. The window width is less than the width of a plurality of the wall panels that are part of a truss positioned above and/or below the window.

A truss can be provided that is formed in part of a plurality of short wall panel sections that are attached above and below to truss beams, the truss having edge portions that connect to full length wall panel edge portions.

Vertical columns can be provided that support the truss at positions on opposing sides of a window, wherein the distance between the columns is greater than the width of the window. Each of the columns preferably supports an end portion of the truss that is supported above the window. A somewhat similar arrangement utilizes a truss above each door. Each column can include a pair of sections that are movable relative to one another.

Corner constructions are provided that enable standard width interlocking wall panels to be utilized. In one embodiment, the corner construction uses a corner panel having two panels or legs that form an angle of about ninety degrees and that can be of the same length or different lengths.

In another embodiment, a corner column of special configuration connects with a pair of corner panels that can be of the same length or different length.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

For a further understanding of the nature, objects, and advantages of the present invention, reference should be had to the following detailed description, read in conjunction with the following drawings, wherein like reference numerals denote like elements and wherein:

Figure 1 is a perspective view of the preferred embodiment of the apparatus of the present invention;

Figure 2 is a fragmentary exploded perspective view of the preferred embodiment of the apparatus of the present invention;

Figure 3 is a partial perspective view of the preferred embodiment of the apparatus of the present invention;

Figure 4 is a partial perspective view of the preferred embodiment of the apparatus of the present invention;

Figure 5 is a sectional view taken alone lines 5-5 of figure 3;

Figure 6 is a partial perspective view of the preferred embodiment of the apparatus of the present invention;

Figure 7 is an exploded partial perspective view of the preferred embodiment of the apparatus of the present invention illustrating an optional corner construction;

Figure 8 is a partial perspective view of the preferred embodiment of the apparatus of the present invention illustrating an optional corner construction;

Figure 9 is a partial elevation view of the preferred embodiment of the apparatus of the present invention;

Figure 10 is a partial perspective exploded view of the preferred embodiment of the apparatus of the present invention;

Figure 11 is a partial perspective view of the preferred embodiment of the apparatus of the present invention;

Figure 12 is a partial plan view of the preferred embodiment of the apparatus of the present invention illustrating one of the columns that can be used to support a window or door truss;

Figure 13 is a partial perspective view of the column shown in figure 12;

Figure 14 is a partial perspective view of the column

shown in figure 12;

Figure 15 is a fragmentary plan, sectional view of the preferred embodiment of the apparatus of the present invention;

Figure 16 is a partial perspective view of the preferred embodiment of the apparatus of the present invention;

Figure 17 is a partial perspective view of the preferred embodiment of the apparatus of the present invention illustrating a portion of the wall;

Figure 18 is a partial perspective view of the preferred embodiment of the apparatus of the present invention illustrating one of the lower longitudinal beams having an improved slotted construction;

Figure 19 is a partial perspective view of the preferred embodiment of the apparatus of the present invention illustrating a portion of a wall that utilizes the slotted longitudinal beam of figure 18;

Figure 20 is a partial perspective exploded view of the preferred embodiment of the apparatus of the present invention illustrating the door construction;

Figure 21 is a sectional view taken along lines 21-21 of figure 20;

Figure 22 is a partial perspective view of the preferred embodiment of the apparatus of the present invention, illustrating an optional corner construction;

Figure 23 is a top view taken along lines 23-23 of figure 22;

Figure 24 is fragmentary schematic plan view illustrating assembly of the corner construction of figures 22 and 23;

Figure 25 is a fragmentary view illustrating part of the corner construction of figures 22-24;

Figure 26 is a schematic plan view illustrating another corner construction for use with the preferred

embodiment of the apparatus of the present invention;

Figure 27 is a partial perspective view of the corner construction of figure 26;

Figure 28 is a plan, cut-away view of the corner construction of figures 25 and 26;

Figure 29 is a partial perspective view of the preferred embodiment of the apparatus of the present invention illustrating an optional wall panel that is insulated;

Figure 30 is a sectional view of taken along lines 30-30 of figure 29;

Figure 31 is a fragmentary perspective view of the panel of the figures 29 and 30;

Figure 32 is a partial perspective view of the preferred embodiment of the apparatus of the present invention illustrating the wall construction of figures 29-30 used to construct a wall;

Figure 33A is a partial perspective view of the preferred embodiment of the apparatus of the present invention showing another optional corner construction; and

Figure 33B is a partial perspective view of the preferred embodiment of the apparatus of the present invention showing another optional corner construction.

DETAILED DESCRIPTION OF THE INVENTION

The present invention provides a metal building 10 that can be constructed of a plurality of connected walls 11, 12, 13, 14 and a cover or roof 17. Each door 11, 12, 13, 14 can be a solid wall or can be fenestrated, providing one or more windows 16 and/or one or more doors 15. Building 10 can be constructed upon slab 63.

Each wall 11, 12, 13, 14 is constructed of a plurality of interlocking panels. A wall that is not fenestrated is constructed using a plurality of full length panels 18 that can each be of a slected standard height, e.g. eight, ten, twelve or more feet tall. In figure 2-5, each panel 18 is

preferably vertically extended and connected to an adjacent panel (or panels) 18 or to a corner panel 37, 102, 103 (see figures 7, 23-25, 27-28).

In figure 5, the panel 18 can be seen in a plan sectional view to show its transverse cross section. Panel 18 has an enlarge planar front panel 19 connected to a pair of opposed side panels 20, 21. Each panel 20, 21 is an interlocking panel that enables one panel 18 to interlock with another panel or 18 or with a correspondingly shaped portion of a corner panel or a truss.

The interlocking portions include Z-shaped sections 22, 23 that define an interface between the side panels 20, 21 and enlarged planar front panel 19. Enlarged planar front panel 19 can be flat, defining a plane that is also the plane of the wall 11, 12, 13 or 14 that it is a part of Side panels 20, 21 preferably form an angle of about ninety degrees with enlarged planar front pant 19.

Each wall panel 18 has a pair of opposed rear panels 24, 25. Rear panels 24, 25 extend inwardly toward each other as shown in figure 5. Z-shaped portions 22, 23 include diagonally extending sections 26, 28 respectively. The Z-shaped portions 22, 23 include side panel sections that form an acute angle with a diagonally extended section 26 or 28. In figure 5, diagonal section 26 forms an acute angle with side panel section 27. Side panel section 27 can form an angle of about ninety degrees with front panel section 19. Diagonal section 26 forms a acute angle with side panel section 30. Side panel section 30 forms an angle of about ninety degrees with rear panel section 24.

Similarly, Z-shaped portion 23 includes diagonal section 28 that forms an acute angle with each of the side panel sections 29, 31. Side panel section 29 forms an angle of about ninety degrees with front panel section 19. Side panel section 31 forms an angle fo about ninety

degrees with rear panel section 25. Each rear panel section 24, 25 can be strengthened by a transverse panel that extends from each real panel 24, 25 toward front panel 19 as seen in figure 5.

Each panel 18 can be slotted to retard heat transfer between front panel 18 and rear panels 24, 25. In figures 3 and 4, two rows of slits or slots 32 are shown extending vertically along side panel section 20. Similarly positioned slits 32 can be provided on side panel section 21. The slits 32 have gaps 33 therebetween. Each row of slits 32 is separated from the other by space 34 (see figure 4). The slits 32 are staggered as shown so that a gap 33 of one row of slits 32 aligns with the center part of a slit 32 in a different row as seen in figure 5. Any other pattern of slits or holes or openings can be provided in the side panel sections 20, 21 that retards heat transfer between front panel section 19 and rear panel sections 24, 25.

In figures 1, 2, 6, 7, 8, 9, 16, a wall 11-14 can be constructed of wall panels 18, corner panels 37, 102, 103 and longitudinal beams 35, 36. The beams 35, 36 can be channel beams as shown. A lower longitudinal beam 36 supports and is connected to wall panels 18. An upper longitudinal beam 35 connects to the upper end of a plurality of wall panels 18.

Fasteners such as sheet metal screws 38 can be used to fasten panels 18 to beams 35, 36. Fasteners such as sheet metal screws 38 can be used to fasten wall panels 18 together (see figure 2). Fasteners such as sheet metal screws 38 can be used to attach beam 35, 36 and panels 18 to corner panel section 37 (see figure 7). At a corner of the building 10, one beam 35 can be cut to provide cut-out or opening 39 that receives another beam 35.

A corner is constructed as shown in figures 7 and 8. Each corner is designated generally by the numeral 42 and

is constructed using corner panel 37 and its reinforcement 46. Panel 37 includes two panel sections 40, 41 that are joined together at bend 43 forming an angle of about ninety degrees. Each corner panel 37 has interlocking panels 44, 45. Panel section 40 has interlocking panel 44. Panel 41 has interlocking panel 45.

Interlocking panels 44, 45 are constructed in the same fashion as the side panels 20, 21 of figure 5. In fact, the corner panel 37 can be constructed by bending a wall panel 18. In this fashion, as the wall panels 18 will interlock, one panel with the next as shown in figures 2 and 16, a corner panel 37 will interlock with two side panels 18. Corner reinforcement 46 has flanges 47, 48 that attach respectively to panels 40, 41 as shown in figure 8. The corner reinforcement 46 provides a number of different panel sections that are connected at bends 50 or 52 as shown in figure 7. Panel section 49 connected to panel section 51 at bend 50 and panel section 51 connects with panel section 53 at bend 52. Panel sections 51, 53 form an angle of about ninety degrees. A recess 57 that receives Sheetrock® or other inside wall panels 58. Panels 58 can be Sheetrock®, synthetic wood, wood, or any other inside wall panel material known in the art.

Corner reinforcement 46 includes panel section 55 that connects to panel section 53 at bend 54. Bend 56 forms a connection between flange 48 and panel section 55. Fasteners such as sheet metal screws 38 can be used to attach reinforcement 46 to corner panel 37. Fasteners such as sheet metal screws 38 can be used to attach wall panels 18 to corner panel 37 and wherein interlocking portions 44, 45 form interlocking connections as shown in figure 8 with the side panels 21, 20 respectively of wall panels 18.

Figures 9-16 show a construction of a wall 12, 13, 14 that provides a window 16. In figure 9, wall 13 is comprised of an upper longitudinal beam 35, lower

longitudinal beam 36, a plurality of full length metal wall panels 18, a truss 60, and a plurality of short wall panels 59. The window 16 provides a window opening width 61 and a window opening height 62. In figure 9, the window width 61 is less than the distance defined by a plurality of panel sections 18 or 59. For example, in figure 9, there are five short wall panels 59 above and five short wall panels below window opening 16. The combined width 67 of these five panels 59 is more than the width 61 of the window opening 16. This construction enables a column 68 to be placed under each end portion of truss 60 and at the same time interlock with a full length wall panel 18. In figures 10 and 11, each wall panel 59 includes an interlocking end portion that is of the same configuration as the interlocking portions of the side panels 20, 21 of a full length wall panel 18 as shown in figure 5. These interlocking portions 69, 70 at the end of each truss 60 for interlocking a column 68 that supports an end portion of truss 60.

The truss also includes inside plate reinforcement member 64 that includes panels 65 and 66 that form an angle of about ninety degrees. To complete the truss 60, upper and lower longitudinal beams 35, 36 respectively are attached to the top and bottom of the connected short wall panel sections.

Figures 12-16 show more particularly the construction of a column 68 and its interlocking connection with an end portion of truss 60. Each column 68 is of preferably two parts. These include column part 71 and column part 72. The column part 71 can include three intersecting flanges 73, 74, 75 and a recess 76 that receives column part 72. The column part 72 includes an interlocking portion 77 that forms an interlocking connection with an interlocking portion 69, 70 of truss 60.

The interlocking connection between part 77 of column

part 72 and an interlocking portion 69 or 70 of truss 60 can be seen in figure 15 and is the same interlocking connection that employs Z-shaped portions used to connect wall panels 18 together and used to connect a wall panel 18 to a corner panel 37.

In addition to the interlocking portion 77, column part 71 includes flanges 78, 79, 80. As indicated by arrows 81, 82 in figures 12 and 15 the column parts 71, 72 are adjustable with respect to each other so that the distance between flange 74 and flange 79 can be selected and then affixed using a fastener 38 such as a sheet metal screw.

In this fashion, any window of desired width 61 can be made by selecting a column 68 that has a combined installed width 83 that is equal to one-half the distance that remains when subtracting the overall width of the truss 67 (always a multiplier of a panel 18 or 59 width) minus the width 61 of the window. Because each column 68 interlocks with a full length panel 18 and because each truss 60 interlocks with a full length panel 18, a very strong rigidified construction can be obtained for any wall 13 that includes a window opening 16.

In figure 17, 18, 19 a lower longitudinal beam 84 is shown that is comprised of a web 85 and a pair of flanges 86, 87 each preferably forming an angle of about ninety degrees with the web 85. Both web 85 and flange 87 are slotted. Preferably, the slot is L-shaped, so that at about the same position along the beam 84, the flange 87 is completely slotted and the web 85 is partially slotted. This construction can be seen in figure 18 wherein the slot 88 is comprised of a slotted portion 89 on flange 87 and a slotted portion 90 on web 84.

Lower longitudinal beam 84 slotted portion 90 enables the front panel section 19 of a full length wall panel 18 to be placed outside of flange 87, contacting the outer

surface 91 of flange 87. Such a construction is useful when the building 10 to be construction is subjected to a rainy environment. The interlocking side portions 20, 21 of wall panels 18 pass through the slotted portion 89 and flange 87 as shown in figures 17 and 19. The slotted portion 90 provides a drain so that any water that does accumulate on web 85 of beam 84 will drain through slotted portion 90.

Figures 20 and 21 show a wall construction for wall 12 that has door opening 15. As with a window, a truss 60 is placed over the door opening 15, the width of the truss being greater than the width of the door opening 15. The truss is supported with a pair of opposed door frame panels 92, each having an interlocking section 93 that forms an interlocking connection with a side panel 20 of a full length wall panel 18. This interlocking connection can be seen in figure 21. Opposite interlocking section 93 is a non-interlocking side panel 94 that can be reinforced with a vertically extended column 96 that can be in the shape of a channel beam. The door frame panel 92 can provide rear panels 95 to which Sheetrock® or other inside wall panel material 58 can be attached.

In figures 22-25, a corner 97 forms the connection between two walls 11, 14. Corner 97 employs a corner column 98 constructed of two column parts 99, 100. These column parts 99, 100 can provide openings 101 so that electrical wiring or plumbing can be routed through the parts 99, 100. It should be understood that similar openings 101 can be provided in the side panels 20, 21 of any full length wall panel 18 or in any other side panel or interlocking section disclosed herein. This enables electrical lines and plumbing to be routed within a wall 11, 12, 13, 14 in between section 19 and inside wall panel 58.

A pair of corner wall panels 102, 103 are connectable

to column 96 using screws 38 or other suitable fasteners. Column parts 99, 100 are also connectable together using fasteners such as screws 38. Arrows 104 in figure 24 illustrate the connection of corner wall panels 102, 103 to column 98. Each corner wall panel 102, 103 provides an interlocking section 105 or 106 that can form an interlocking connection with a full length wall panel 18 such as the interlocking connection shown in figure 2.

Each interlocking section 105, 106 is provided with an inner panel section to which an inside wall panel can be attached. Corner column 98 can also be used with a corner panel 37 shown in figures 7 and 8. Figures 25-26 shows the use of a corner panel in combination with column 98. It should be understood that the dimension A in figure 23 for the distance between the corner column 98 to interlocking section 106 of panel 103 can be the same for both panels 102, 103 or can be different such as dimensions 111, 112 for the panel 37 shown in figures 25-27. In figures 25-27, the dimension 111 is longer than the dimension 112. This construction enables a corner panel 37 or the two corner panels of figures 22-25 to be used to adjust the two length of a wall if the full length panels 18 are of the same width and the wall dimension is not equal to an exact multiplier of that panel width.

In figures 29-32, an insulated arrangement is shown for a full length panel 18. The insulation includes insulation layer 114, inside wall panel 58, sheet metal panel 116, and fastener 117, such as common nail. The construction of figures 29-32 enables a fastener or common nail to be used to attach siding 115 to a wall 11, 12, 13, 14 wherein the nail or fastener penetrates and holds together the siding, inside wall panel 58, insulation 114, and sheet metal panel 116. The sheet metal panel 116 can provide flanges 118 that extend on opposing sides of the insulation 114 as shown in figure 31. Further, the

insulation layer 114 can be grooved on one or all surfaces, providing grooves 119.

Figures 33A-33B show another corner construction that can optionally be used with the apparatus 10 of the present invention. Corner 120 can be constructed using two connecting panels including starting panel 121 and ending panel 122. Standard dimension full length panels 18 can be connected to panels 121, 122 at respective Z shaped portions 137, 142 (see figure 33B). Z shaped portions 137, 142 can be of the same configuration as the Z shaped portions of a full length panel 18 (see figure 5). Upper longitudinal beams 35 can be attached to the top of panels 18, 121, 122, 18 (see arrows 131, 132 in figure 33A). Lower longitudinal beams 36 can be connected to the bottom of connected panels 18, 121, 122, 18.

Outside ell shaped panel 123 can be attached (e.g. with fasteners 38) to the assembly of panels 18, 121, 122, 18 and beams 35, 36 by engaging outside panels 134, 141 as indicated by arrow 126 in figure 33A. Panel 123 has flanges 124, 125 that form an angle of about ninety degrees (90°).

Inside ell shaped panel 127 can be attached to the assembly of beams 35, 36 and panels 18, by attaching (e.g. with fasteners 38) to beams 35, 36 as indicated by arrow 130 in figure 33A. Because flange 136 is shorter (e.g. 1 inch) than the width (e.g. 3½ inches) of beams 35, 36 a gap 147 (e.g. 2½ inches) is provided so that electrical wiring can be routed through corner 120. Inside ell shaped panel 127 is formed of flanges 128, 129 that intersect at an angle of about ninety degrees (90°).

An inside wall veneer can be attached to a building 10 that employs corner 120. In figure 33B, veneer panels 133 (e.g. Sheetrock®) are shown attached to an assembly of panels 18, 121, 122, 123, 127, 18 and beams 35, 36.

Starting panel 121 is comprised of outside panel 134

and transverse end panels 135, 138 attached respectively to opposing ends of panel 134. Panel 135 has flange 136 that is generally parallel to panel 134. Panel 138 connects to panel 134 with Z shaped portion 137. Panel 138 connects to flange 139. Flange 139 connects to flange 140. Flange 139 is generally parallel to panel 134. At corner 120, inside veneer panels 133 (e.g. wood paneling, Sheetrock®, etc. attach to flanges 129 and 139.

Ending panel 122 provides an outside panel 141 that can be dimensioned to satisfy any outside wall dimension that is specified, for example, by an architect. Typically, the outside wall panels 133 selected during construction are of a standard four by eight (4'x8')sheet size. Paneling such as wood paneling, plywood, Sheetrock®, are all typically provided in four by eight (4'x8')foot sheets. Ideally, a wall is sized so that the inside panels 133 (sized four by eight feet) will exactly fit without having to cut a panel 133. However, an architect might select a dimension that requires an inside wall panel 133 to be cut. In such a situation, standard full length panels 18 can be used in combination with starting panel 134 to provide any specified wall dimension. Any extra dimension that is required after a starting panel 121 and a number of standard width panels 18 are erected, can be supplied by a custom sized or cut end panel 122. Ending panel 122 can be manufactured to any dimension, or can be oversized and then cut in the field to fit by cutting outside panel 141.

Ending panel 122 provides Z shaped portion 142, transverse end panel 143, flange 144 (generally parallel with outside panel 141) and flange 145 that forms an angle of about ninety degrees with outside panel 141.

Arrow 146 in figure 33A illustrates the assembly of ending panel 122 to starting panel 121. Fasteners 38 can be used as needed to assemble the panels 121, 122, beams

35, 36, outside ell shaped panel 123, and inside ell shaped panel 128, and inside wall panels 133.

The following is a list of parts and materials suitable for use in the present invention:

PARTS LIST:

Part Number	Description
10	metal building
11	wall
12	wall
13	wall
14	wall
15	door
16	window
17	roof
18	full length panel
19	enlarged planar front panel
20	side panel
21	side panel
22	Z-shaped section
23	Z-shaped section
24	rear panel
25	real panel
26	diagonally extending section
27	side panel section
28	diagonally extending section
29	side panel section
30	side panel section
31	side panel section
32	slit or slot
33	gap
34	space
35	upper longitudinal beam
36	lower longitudinal beam
37	corner panel
38	screw

39	cut-out
40	panel section
41	panel section
42	corner
43	bend
44	interlocking panel
45	interlocking panel
46	corner reinforcement
47	flange
48	flange
49	panel section
50	bend
51	panel section
52	bend
53	panel section
54	bend
55	panel section
56	bend
57	recess
58	inside wall panel
59	short wall panel
60	truss
61	width
62	height
63	slab
64	inside plate reinforcement
65	panel
66	panel
67	combined width
68	column
69	interlocking portion
70	interlocking portion
71	column part
72	column part
73	flange

74	flange
75	flange
76	recess
77	interlocking part
78	flange
79	flange
80	flange
81	arrow
82	arrow
83	width
84	beam
85	web
86	flange
87	flange
88	slot
89	slotted portion
90	slotted portion
91	outer surface
92	door frame panel
93	interlocking section
94	side panel
95	rear panel
96	column
97	corner
98	corner column
99	column part
100	column part
101	opening
102	corner wall panel
103	corner wall panel
104	arrow
105	interlocking section
106	interlocking section
107	inner panel section
108	inner panel section

109	arrow
110	dimension line
111	dimension line
112	dimension line
114	insulation layer
115	siding
116	sheet metal panel
117	fastener
118	flange
119	groove
120	corner
121	starting panel
122	ending panel
123	outside ell shaped panel
124	flange
125	flange
126	arrow
127	inside ell shaped panel
128	flange
129	flange
130	arrow
131	arrow
132	arrow
133	inside wall panel
134	outside panel
135	transverse end panel
136	flange
137	Z shaped portion
138	transverse end panel
139	flange
140	flange
141	outside panel
142	Z shaped portion
143	transverse end panel
144	flange

145	flange
146	arrow
147	gap

All measurements disclosed herein are at standard temperature and pressure, at sea level on Earth, unless indicated otherwise. All materials used or intended to be used in a human being are biocompatible, unless indicated otherwise.

The foregoing embodiments are presented by way of example only; the scope of the present invention is to be limited only by the following claims.